



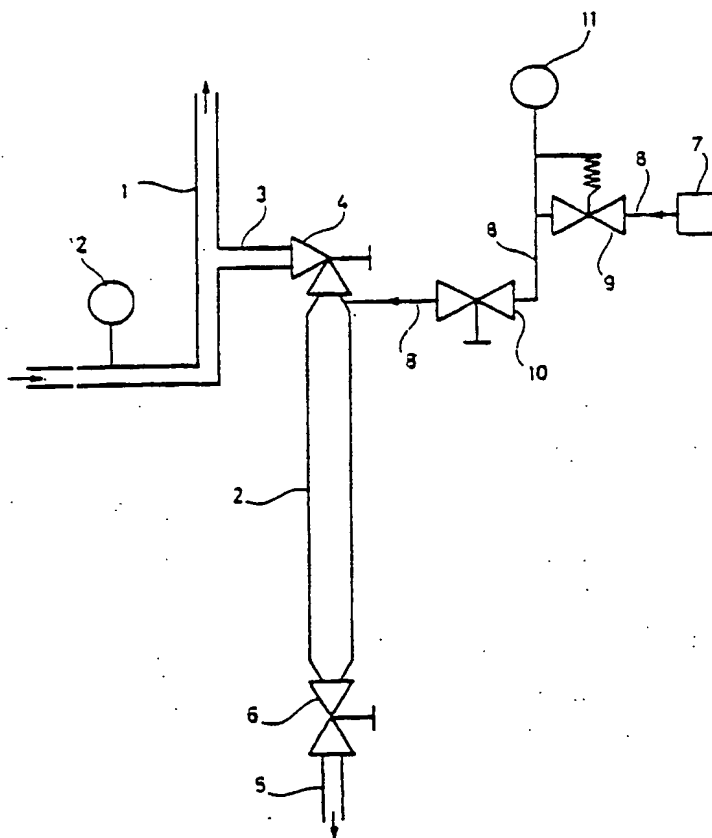
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: <b>PCT/SE87/00307</b></p> <p>(22) International Filing Date: <b>29 June 1987 (29.06.87)</b></p> <p>(31) Priority Application Number: <b>8602973-3</b></p> <p>(32) Priority Date: <b>4 July 1986 (04.07.86)</b></p> <p>(33) Priority Country: <b>SE</b></p> <p>(71) Applicant (for all designated States except US): <b>ALFA-LAVAL FOOD &amp; DAIRY ENGINEERING AB [SE/SE]; Box 64, S-221 01 Lund (SE).</b></p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only) : <b>PALM, Bengt [SE/SE]; Nylyckevägen 4, S-240 13 Genarp (SE).</b></p> <p>(74) Agent: <b>CLIVEMO, Ingemar; Alfa-Laval AB, P.O. Box 500, S-147 00 Tumba (SE).</b></p>	<p>(81) Designated States: <b>AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK, FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US.</b></p> <p><b>Published</b> <i>With international search report.</i> <i>In English translation (filed in Swedish).</i></p>	

(54) Title: A METHOD AND A DEVICE FOR ASEPTIC TRANSFER OF AN AMOUNT OF LIQUID FROM ONE SPACE TO ANOTHER

## (57) Abstract

A device for aseptic transfer of a batch of liquid from a first space (1) containing such liquid under a given pressure to a second space (2) comprises a channel (3) for liquid, which connects the first space with the second space, and a valve (4) adapted for opening and closing of the liquid channel (3). According to the invention, a source (7) is arranged for production of a sterile gas with a pressure, which at least substantially amounts to said given pressure, and with a condensation temperature which at said given pressure is higher than the temperature of the liquid. The gas source (7) is connected with the second space (2) via a gas channel (8), which is adapted to be opened and closed by means of a gas valve (10). The invention also relates to a method of aseptic transfer of a quantity of liquid from a first space (1) containing such liquid under a given pressure to a second space (2). The invention may be utilized for sampling a liquid, whereby said second space (2) for instance may be constituted by the interior of a sampling receptacle.



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A METHOD AND A DEVICE FOR ASEPTIC TRANSFER OF  
AN AMOUNT OF LIQUID FROM ONE SPACE TO ANOTHER

The present invention relates to a method of aseptic transfer  
5 of a batch of liquid from a first space, which contains such a  
liquid under a given pressure, to a second space. The invention  
also relates to a device for accomplishing this method.

In a known process for the production of sterilized and packed  
10 liquid food, for instance berry juice, cream, sauce, soup etc.,  
the food is first sterilized in a sterilizer, after which it is  
conveyed further in conduits to an aseptic packing machine, if  
necessary via an aseptic intermediate storing container. During  
the running of the process the sterility of the food must be  
15 confirmed by regularly testing the bacterial content of the  
food. One way of accomplishing such tests is by testing samples  
of the content in the filled packages. Another way is to draw  
off minor quantities of food for testing via valves, which can  
be arranged at different places along the process line. The  
20 latter way is applied in practice such that an open container  
is kept in the vicinity of a valve of the said kind, while the  
latter is opened during a short period of time. Usually there is  
an arrangement which creates an approximately sterile environ-  
ment around the valve.

25 A drawback with the first-mentioned way of testing is that at  
discovery of packages with unsterile content, it is impossible  
to directly state where in the process defects have arisen.  
Locating faults will therefore be time-consuming and expensive.  
30 A drawback with the last-mentioned way is that said valves  
often mechanically affect the quantity of food drawn off in an  
undesirable way. Often the food contains delicate coarse partic-  
les as whole berries, beans, carrots in the form of cubes etc.  
These particles sometimes partly clog an open valve, whereby the  
35 food is filtrated when passing through the valve. Of course,

also such coarse particles should be included in the sterility test. However, if a valve is opened sufficiently much to permit passage of the coarse particles the flow of food through the valve can be unallowably large into the used, normally relatively small open receptacle, since the liquid food is under a certain overpressure in the process apparatus. In certain cases the particles can be mashed when passing through the valve, which means a change of the consistency of the food. Test samples obtained through valves therefore are often not completely significant of the food in the process apparatus. Further, it is difficult to accomplish sampling of food via valves during aseptic conditions. Thus, the samples can be infected by bacteria during the sampling, which of course will give a wrong indication of the condition of the food treated in the process.

The object of the present invention is to avoid the above described drawbacks with the known ways of testing the bacteria consistency of sterilized liquid food by providing a new method, which admits aseptic transfer of a limited quantity of food from an optional place in a process apparatus to a sampling receptacle without the food being changed and which in addition admits aseptic transfer of relatively coarse particles in the food to the sampling receptacle. A further object of the present invention is to provide a simple device for accomplishing such a method.

These objects are obtained according to the invention in a method of the kind initially mentioned, by filling the second space with a sterile gas such that the pressure in this second space at least amounts to substantially said given pressure in the first space, the gas having a condensation temperature, which at said given pressure is higher than the temperature of the liquid; that after the gas filling of the second space this is brought to communicate with the first space, such that the

gas in the second space is condensated by contacting the liquid in the first space, whereby liquid is brought to stream from the first space to the second space; and that the communication between the first and second spaces then is interrupted, so that  
5 the liquid in the second space is separated from remaining liquid in the first space.

By this method the advantage is obtained, thanks to the gas pressure in the second space, that communication between the  
10 first and second spaces can be established, for instance by opening a valve in a connection channel between the spaces, without the liquid in the first space immediately start streaming into the second space. Thus, there is time for complete opening of the valve before liquid starts streaming through  
15 this. Consequently, it can be avoided that coarse particles in the liquid clog the passage of the valve or that said particles are divided into pieces when streaming through the valve before this is completely opened. It will also be possible to utilize a valve of such a size that the coarse particles easily can pass  
20 through it when it is completely opened, since the condensation of the gas takes place very slowly in the beginning after opening of the valve to increase later the more the heat exchanging contact between the liquid and the gas is established. Therefore, there is time for complete opening of the  
25 valve while the liquid flow into the second space still is of a marginal size.

The invention also relates to a device for aseptic transfer of a batch of liquid from a first space, which contains such liquid  
30 under a given pressure, to a second space, said second space being adapted to take up the entire said batch of liquid to be transferred, said transfer device comprising a channel for liquid, which connects the first space with the second space, and a valve adapted for opening and closing of the liquid  
35 channel. The device according to the invention is principally

characterized by a source for production of a sterile gas with a pressure, which at least amounts to substantially said given pressure, and with a condensation temperature which at said given pressure is higher than the temperature of the liquid;  
5 a channel for gas, which connects the second space with the gas source; and a gas valve adapted for opening and closing of the gas channel.

Hereby a simple device is obtained for accomplishing the above  
10 described method.

Advantageously, the gas channel opens in the liquid channel in the vicinity of the liquid valve between the latter and the second space. After an accomplished sampling, the gas can be  
15 utilized for cleaning of the outlet portion of the liquid valve and the part of the liquid channel, which is situated between the liquid valve and the second space.

According to a preferred embodiment of the device according to  
20 the invention the second space is provided with an outlet, and a valve is adapted for opening and closing of the outlet. Hereby, the second space functions as a lock for the liquid, so that the sampling receptacles for the liquid can be of a simple and cheap kind, for instance of glass, since these do not need to  
25 resist the pressure variations or sudden temperature changes, which occur in the second space during transfer of liquid from the first space to the second space which is heated by gas. The second space may for instance be constituted by the interior of a pressure vessel of metal, which is resistant to said pressure  
30 variations and sudden temperature changes.

By the function of the second space as a lock for the liquid, the emptying of the second space can easily be controlled, so that the liquid flow from this through the outlet will have a  
35 desired suitable size when filling a sampling receptacle. In

such an emptying of the second space the outlet valve is completely opened while the liquid valve is closed. By supplying gas to the second space the liquid can discharge through the outlet. Hereby the size of the liquid flow is adjusted by  
5 adjusting the size of the gas flow. Suitably the second space is dimensioned such that this can be completely emptied of the liquid quantity in one and the same sampling receptacle.

Advantageously, the outlet is situated in the lower part of the  
10 second space, while the liquid channel can open into the upper part of this. When washing the transfer device by means of for instance steam supplied through the gas channel, formed condensate will hereby automatically drain away through the outlet because of gravity. When emptying the second space of liquid,  
15 which takes place by means of gas supplied to said space at its upper part, it is also highly avoided that the gas will stir and mix with the liquid, whereby the hot gas will not kill any bacteria in the liquid. Because of influence of the gravity on the liquid, the gas will as a piston press the liquid downwards  
20 in the second space towards said outlet.

The invention will be described more closely in the following with reference to the accompanying drawing. In this, figure 1 shows schematically a device according to the invention. Figure  
25 2 shows a section through a part of a preferred embodiment of a device according to the invention.

In figure 1, there is fundamentally shown a device for aseptic transfer of a food in liquid form from a first space to a second  
30 space. The first space is here constituted by the interior of a tube conduit 1 for conveying food between for instance a sterilizer and an aseptic intermediate storing container, but may also be constituted by the interior of the sterilizer or intermediate storing container. The second space is constituted by  
35 the interior of an elongated pressure vessel 2 extending vertically.

sterilization of them by means of steam. In the membrane valve 4 a channel 8 for steam is connected to the outlet part of the valve in the vicinity of the valve seating. Hereby the inner outlet portions of the membrane valve 4 that are most difficult of access will be safely cleared and sterilized when supplying steam at a sampling course. Analogous to the device shown in figure 1 an elongated pressure vessel 2 is connected with its upper end to the membrane valve 4 and with its lower end to the membrane valve 6.

10

At the outlet 5 an aseptic filling device 13 is arranged comprising a shield 14 surrounding the outlet 5 and forming a chamber 15 with a downwards directed opening. The shield 14 is in its upper part provided with an inlet 16 for supply of a sterile gas, for instance steam, to the chamber 15. A strainer plate 17 fixed to the shield 14 divides the chamber 15 in an upper part, in which the inlet 16 for sterile gas is situated, and a lower part, in which the outlet 5 opens in downwards direction. Two holders 18 and 19 for lids to sampling receptacles are fastened to the underside of the strainer plate 17 in the lower part of the chamber 15.

20

The aseptic filling device 13 is used in the following way:

Steam is continuously supplied to the upper part of the chamber 15 via the inlet 16 and streams downwards to the strainer plate 17. This spreads the steam flow so that steam flows evenly into the entire lower part of the chamber 15 and leaves this via the downwards directed opening of the chamber. Hereby the chamber is kept sterile by the steam. A sterilized sampling receptacle 20, which is sealed with a lid 21, is brought with the lid portion up into the lower part of the chamber 15 and is fastened by pushing the lid 21 against the lid holder 18. (The lid holder 19 is intended for lids of smaller dimension than the lid 21). The sampling receptacle 20 is loosened from the lid 21, which is

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temperature of the steam at said pressure, the steam begins to condensate. Hereby the pressure in the pressure vessel 2 decreases, which means that liquid slowly is sucked from the tube conduit 1 into the connection channel 3. When liquid begins to reach into the pressure vessel 2 the condensation takes place very quickly, the pressure vessel 2 being filled completely with liquid and with a small insignificant quantity of water from the condensating steam.

When the pressure vessel is filled the liquid valve 4 is closed, after which the outlet valve 6 is opened. Then the gas valve 10 is opened slightly, so that steam streaming into the upper part of the pressure vessel 2 presses the liquid quantity in the pressure vessel downwards and out through the outlet 5 for aseptic filling on a sterile receptacle by means of an aseptic filling device not shown. The elongated pressure vessel 2 is oriented substantially vertically to prevent as far as possible stirring of the liquid and mixing of steam into this during the emptying of the pressure vessel, since the heat steam could kill any bacteria in the sample batch, which thus would be spoiled.

Alternatively, it is also conceivable that the second space may be constituted by the interior of a sampling receptacle. In such a case this must be formed resistant to pressure variations and quick temperature changes.

In figure 2 there is shown a practical design of a part of a device according to the invention provided with an aseptic filling device for sampling receptacles. Corresponding details in figures 1 and 2 are provided with the same reference numerals.

In the device according to figure 2 the valves 4 and 6 in the connection channel 3 and outlet 5, respectively, are constituted by membrane valves. Such valves are well suited for cleaning and

Claims

1. A method of aseptic transfer of a batch of liquid from a first space containing such liquid under a given pressure, to a second space, c h a r a c t e r i z e d i n

- that the second space (2) is filled with a sterile gas, such that the pressure in this second space at least amounts to substantially said given pressure in the first space (1), the gas having a condensation temperature, which at said given pressure is higher than the temperature of the liquid,

- that after the gas filling of the second space (2) this is brought to communicate with the first space (1), such that the gas in the second space is condensed by contacting the liquid in the first space, whereby liquid is brought to stream from the first space to the second space, and

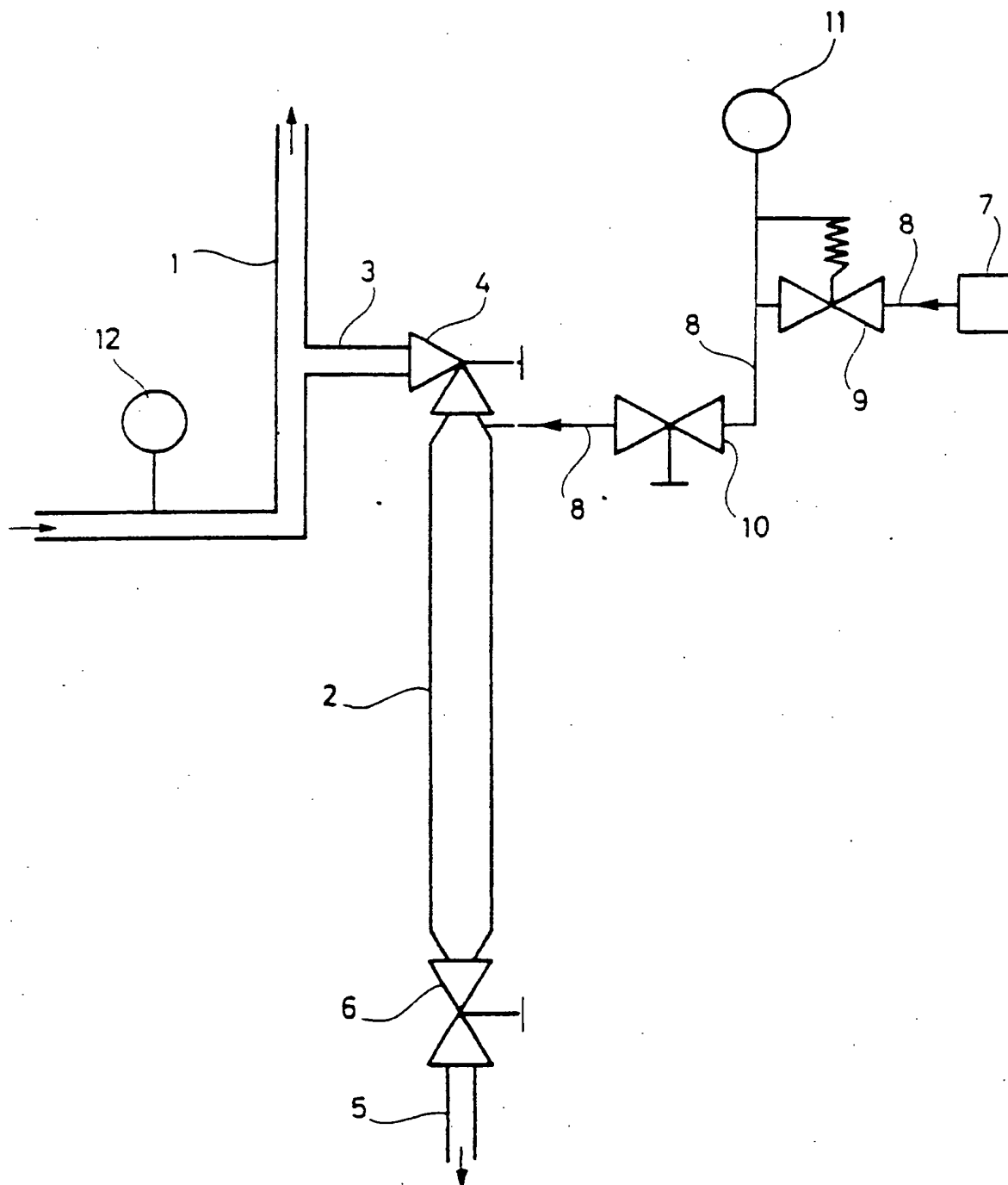
- that the communication between the first and second spaces (1, 2) is then interrupted, so that liquid in the second space (2) is separated from remaining liquid in the first space (1).

2. A device for aseptic transfer of a batch of liquid from a first space (1), containing such liquid under given pressure, to a second space (2), the second space (2) being adapted to take up the entire said batch of liquid to be transferred, which transfer device comprises a channel (3) for liquid connecting the first space with the second space, and a valve (4) adapted for opening and closing of the liquid channel (3), c h a r a c - t e r i z e d b y

- a source (7) for production of a sterile gas with a pressure, which at least amounts to substantially said given pressure, and with a condensation temperature which at said given pressure is higher than the temperature of the liquid,

kept by the lid holder 18. Without the upper portion of the receptacle leaving the sterile environment in the lower portion of the chamber 15, the receptacle 20 is then brought to a position, in which the opening of the receptacle is in front of the opening of the outlet 5. When the receptacle 20 is in said position the membrane valve 6 is opened, after which steam is supplied to the interior of the pressure vessel 2 via the channel 8, so that the liquid amount present in the pressure vessel is pressed down into the receptacle 20. Without the upper portion of the receptacle leaving the sterile environment in the lower portion of the chamber 15, the filled receptacle 20 is brought back to the lid holder 18 and is there sealed by the lid 21, which is held by the lid holder. The receptacle 20 with its lid 21 is thereafter loosened from the lid holder 18 and is brought out of the chamber 15.

In the described exemplified embodiments of the transfer device according to figures 1 and 2, the second space is constituted by the interior in a pressure vessel with unchangeable inner volume. However, alternatively it would be possible to utilize the interior of a vessel having flexible walls. When gas condensates in a vessel of the last-mentioned kind the walls in this will move towards each other so that the inner volume of the vessel decreases. However, since the liquid food is under an overpressure, the food streaming into the vessel will enlarge its inner volume back to the original size.

Fig.1 ✓

- a channel (8) for gas connecting the second space (2) with the gas source (7), and

5 - a gas valve (10) adapted for opening and closing of the gas channel (8).

3. A device according to claim 2, characterized in that the gas channel (8) opens into the liquid channel (3) in the vicinity of the liquid valve (4) and between the latter  
10 and the second space (2).

4. A device according to claims 2 or 3, characterized in that the second space (2) is provided with an outlet (5) and a valve (6) adapted for opening and closing of  
15 the outlet (5).

5. A device according to claim 4, characterized in that the outlet (5) is situated in the lower part of the second space (2).

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6. A device according to any of claims 2-5, characterized in that the liquid channel (3) opens into the upper part of the second space (2).

# INTERNATIONAL SEARCH REPORT

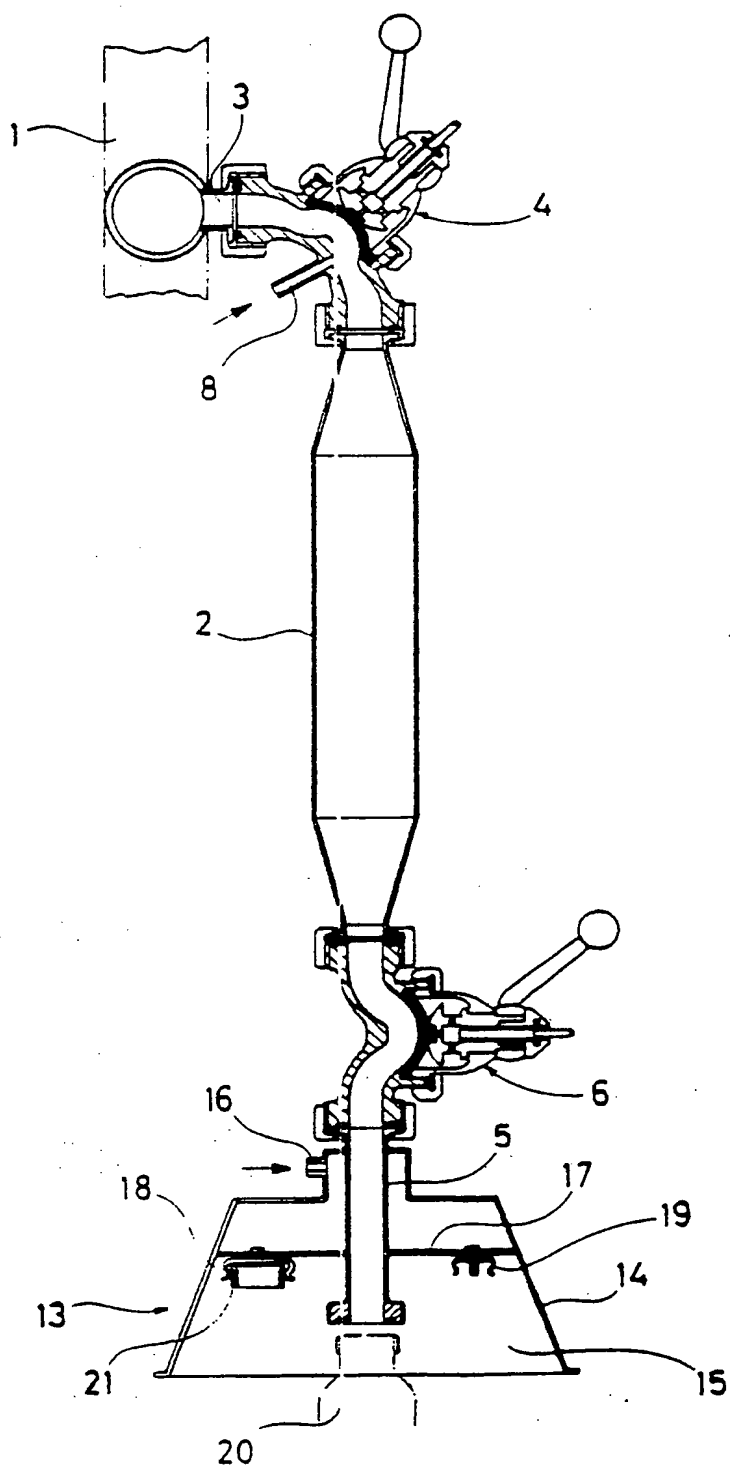
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International Application No

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) * According to International Patent Classification (IPC) or to both National Classification and IPC C 12 M 1/26, G 01 N 1/14 <span style="float: right;">4</span>																	
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched <sup>7</sup></div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%; text-align: left; border-bottom: 1px solid black;">Classification System</th> <th style="text-align: left; border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="vertical-align: top; border-right: 1px solid black; padding: 5px;">IPC</td> <td style="padding: 5px;">C 12 M 1/00, /12, /25, /28; G 01 N 1/14; B 65 B 3/04, /10, /14, /26, /30, /32, 31/00-/08; B 65 D 81/18-/22 .../...</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup></div> <p style="padding: 10px 0 0 40px;">SE, NO, DK, FI classes as above</p>			Classification System	Classification Symbols	IPC	C 12 M 1/00, /12, /25, /28; G 01 N 1/14; B 65 B 3/04, /10, /14, /26, /30, /32, 31/00-/08; B 65 D 81/18-/22 .../...											
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<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>1</sup></b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; text-align: left; border-bottom: 1px solid black;">Category <sup>9</sup></th> <th style="text-align: left; border-bottom: 1px solid black;">Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup></th> <th style="text-align: left; border-bottom: 1px solid black;">Relevant to Claim No. <sup>13</sup></th> </tr> <tr> <td style="vertical-align: top; border-right: 1px solid black; padding: 5px;">A</td> <td style="padding: 5px;">SE, B, 356 682 (TETRA PAK INTERNATIONAL AB) 4 June 1973</td> <td style="padding: 5px;">1, 2</td> </tr> <tr> <td style="vertical-align: top; border-right: 1px solid black; padding: 5px;">A</td> <td style="padding: 5px;">DE; A, 2 614 542 (GESELLSCHAFT FUR BIO-TECHNOLOGISCHES FORSCHUNG) 10 November 1977</td> <td style="padding: 5px;">1, 2</td> </tr> <tr> <td style="vertical-align: top; border-right: 1px solid black; padding: 5px;">A</td> <td style="padding: 5px;">Derwents Abstract No. 19441 K/08, SU 922 006.</td> <td style="padding: 5px;">1, 2</td> </tr> <tr> <td style="vertical-align: top; border-right: 1px solid black; padding: 5px;">A,X</td> <td style="padding: 5px;">Derwents Abstract No. 84-230391/37 SU 1068474.</td> <td style="padding: 5px;">1, 2-6</td> </tr> </table>			Category <sup>9</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>	A	SE, B, 356 682 (TETRA PAK INTERNATIONAL AB) 4 June 1973	1, 2	A	DE; A, 2 614 542 (GESELLSCHAFT FUR BIO-TECHNOLOGISCHES FORSCHUNG) 10 November 1977	1, 2	A	Derwents Abstract No. 19441 K/08, SU 922 006.	1, 2	A,X	Derwents Abstract No. 84-230391/37 SU 1068474.	1, 2-6
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A,X	Derwents Abstract No. 84-230391/37 SU 1068474.	1, 2-6															
* Special categories of cited documents: <sup>10</sup> "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed		"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family															
<b>IV. CERTIFICATION</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">           Date of the Actual Completion of the International Search            1987-09-16         </td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">           Date of Mailing of this International Search Report            1987-09-22         </td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">           International Searching Authority            Swedish Patent Office         </td> <td style="border-bottom: 1px solid black; padding: 5px;">           Signature of Authorized Officer             Carl Olof Gustafsson         </td> </tr> </table>			Date of the Actual Completion of the International Search 1987-09-16	Date of Mailing of this International Search Report 1987-09-22	International Searching Authority Swedish Patent Office	Signature of Authorized Officer Carl Olof Gustafsson											
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L.E.

Fig. 2



## FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

II

## Fields Searched (cont).

US C1 435: 292;  
53: 426;  
141: 99, 47-51, 63;  
73: 425.6, 863.11, 863.12,  
863.71-73, 863.81, 864.35

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers ..... because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers ..... because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim numbers ..... because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This International Searching Authority found multiple inventions in the international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

## Remark on Protest

- ☐ The additional search fees were accompanied by applicant's protest.  
☐ No protest accompanied the payment of additional search fees.



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